STAT 516 - Spring 2004 - Homework 6

Due: Wednesday, April 7th

1) Three refining processes are available for a chemical company to choose from, and they wish to determine which of them is most effective. Because they are aware that the quality of the unrefined chemical is important, and changes quite a bit, they decide to use a block design. They randomly select five days from the following two months, and divide the incoming chemicals that day into three groups, one for each of the processes (day is thus a random effect). They get the following yields:

	Day				
	1	2	3	4	5
Method A	31.0	39.5	30.5	35.5	37.0
Method B	28.0	34.0	24.5	31.5	31.5
Method C	25.5	31.0	25.0	33.0	29.5

a) Check that the assumptions for performing an ANOVA with this data are met.

b) Why can't you test whether the interactions between day and method are significant?

c) If possible, test the null hypothesis that all three methods perform the same at an α=0.05 level. Verify that you are using the correct F statistic, or say why it is impossible.

d) If possible, test the null hypothesis that variance of the effect of different day's batches is zero at an α=0.05 level. Verify that you are using the correct F statistic, or say why it is impossible.

2) It is desired to see what the effect of three diets (A=full grain, B=partial grain, and C=roughage) is on the milk production of cows (in pounds per week). Unfortunately because cows are highly variable in their milk production, if you didn't block on cow the sample size would have to be very large. Similarily, one should account for the change in milk production over time. It was decided to do a latin square design with three randomly selected cows (I, II, III) over a span of 18 weeks (grouped into 1-6, 7-12, and 13-18).

a) Based on the data below, does diet seem to have an effect?

b) Which diet(s) perform significantly better than the others?

c) What is the estimate of the variance of the effect on weekly milk production due to the cows?

	Weeks		
Cow	1-6	7-12	13-18
I	A 608	B 716	C 845
II	B 885	C 1086	A 711
III	C 940	A 766	B 832

(This problem is adapted from an example in Cobb, 1998, and the data originally appeared in the Journal of Dairy Science in 1941.)